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Moorella Strains for the Production of Biochemicals from Syngas

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In the process of sugar fermentation, a significant portion of lignocellulosic biomass is left unused. An alternative is the gasification into syngas, a carbon-rich gas mixture. Syngas serves as energy and carbon source for acetogenic bacteria, which can then produce biochemicals. In the syngas fermentation process even the recalcitrant lignin portion can be fully converted into higher value compounds.

Still the cost-effectiveness of this process requires better understanding of the metabolism and modification of the acetogenic strains. In my PhD project I am laying the basis for production of higher value biochemicals (acetone) from syngas using Moorella strains as cell factories. Moorella has outstanding abilities that make it especially suitable for the syngas fermentation process (thermophily, carbon source utilization). Firstly, the project focuses on understanding the primary metabolism in acetogenic bacteria. The main research aspect is to determine acceptance of, and the exact growth rates on different carbon sources (C1, C6, gaseous substrates) in different Moorella strains. Genome analysis on pathway level is performed to link the genotype to the phenotype. Differential expression analysis between heterotrophic and autotrophic growth (RNA-seq) serves to elucidate the regulatory mechanisms underlying carbon source utilization.

In the second part of my project I am developing tools for genetic manipulation of Moorella strains. For example, a pyrF deletion strains, which allows heterologous gene expression was constructed. These tools developed in my project will be applied to engineer bacterial cell factories for production of higher value biochemicals like acetone.